

REMARKS

Claims 14-21 are pending. By this amendment, the specification is amended and claims 14, 19 and 21 are amended. Reconsideration in view of the above amendments and following remarks is respectfully requested.

Claims 14-16 were rejected under 35 U.S. C. §102(e) over Nemoto et al. (U.S. Patent 6,025,213). The rejection is respectfully traversed.

Claim 14 recites a semiconductor light-emitting apparatus of flip chip bonding type including a transparent base made of an inorganic material, which has one side thereof a first bonding pad and a second bonding pad to be connected to a pair of lead frames with a space between the first and second bonding pads where a semiconductor light-emitting element is fixed, the light-emitting element including a positive electrode that covers substantially an entire surface of a light-emitting layer of the light-emitting element, and the positive electrode reflecting light emitted from the light-emitting layer toward the light-emitting layer.

As discussed on page 2, paragraph 2 of the Office Action, Nemoto et al. disclose a semiconductor light-emitting device package 59 including a transparent package window portion 32, a signal deriving electrode pad portion 42, and interconnection pattern 41, a resin mold assembly 33, lead frames 58 and a light coupled device 51. See, for example, Figures 15A-15E.

Figures 13A-13F disclose the method of manufacturing the light coupled device 51. As shown in Figure 13B, the light coupled device 51 includes a laser diode LD portion which emits light as shown in Figure 13E. The light coupled device 51 also includes a photodiode PD. See Figures 10 and 11 of Nemoto et al. also. As disclosed in column 8, lines 53-59, electrodes 77 and 78 are formed on the laser diode LD and the photodiode PD. A common electrode 79 is deposited on the back surface of the substrate 66. As further disclosed in

column 9, lines 12-19, an inclined plane 80 is used as a reflector for reflecting light emitted from the horizontal resonator and face of the laser diode LD so that the reflected light travels in a predetermined direction. The reflector 67 is formed on a crystal plane on which the inclined plane 80 is based and is satisfactorily polished and smooth as a mirror.

There is no disclosure or suggestion by Nemoto et al. of a positive electrode that covers substantially an entire surface of a light-emitting layer of a light-emitting element and that reflects light emitted from the light-emitting layer toward the light-emitting layer as recited in claim 14. As discussed above, Nemoto et al. provide the reflector 67 on the inclined plane 80 of the light coupled device 51 to reflect light toward the light-emitting layer of the light coupled device 51. Accordingly, Nemoto et al. cannot anticipate or render obvious claim 14.

Claim 15 and 16 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claim 14 and for the additional features recited therein.

Reconsideration and withdrawal of the rejection claims 14-16 under 35 U.S.C. §102(e) over Nemoto et al. are respectfully requested.

Claims 17 and 18 were rejected under 35 U.S.C. §103(a) over Nemoto et al. in view of Shimizu (JP 408007614). The rejection is respectfully traversed.

Claims 17 and 18 recite additional features of the invention and are allowable for the same reasons discussed above with respect to claim 14 and for the additional features recited therein. In addition, it is respectfully submitted that Shimizu fail to correct the deficiencies of Nemoto et al. with respect to claim 14 and even assuming it would have been obvious to combine Nemoto et al. and Shimizu, such a combination would have resulted in the invention of claim 14.

Reconsideration and withdrawal of the rejection of claims 17 and 18 under 35 U.S.C. §103(a) over Nemoto et al. in view of Shimizu are respectfully requested.

Claims 19 and 21 were rejected under 35 U.S.C. §103(a) over Nemoto et al. in view of Maruska (U.S. Patent 5,998,232). The rejection is respectfully traversed.

Claim 19 recites a pair of lead frames for use in a light-emitting apparatus of flip chip bonding type including a transparent base, a GaN semiconductor light-emitting device, wherein a first lead frame has a first mount which faces the dominant light-emitting direction of the light-emitting apparatus and on which a first bonding pad is to be fixed, and a second lead frame has a second mount which faces the dominant light-emitting direction on which a second bonding pad is to be fixed, the light-emitting including a positive electrode that covers substantially an entire surface of a light-emitting layer of the light-emitting device, and the positive electrode reflecting light emitted from the light-emitting layer toward the light-emitting layer.

Claim 21 recites a light-emitting diode including a sapphire substrate, a light emitting layer of a GaN semiconductor formed on the sapphire substrate, and a positive electrode formed on the light emitting layer, wherein the positive electrode is supplied with electricity through a wire, reflects light from the light emitting layer toward the sapphire substrate, and covers substantially an entire surface of the light-emitting layer.

As discussed above with respect to claim 14, Nemoto et al. neither discloses nor suggest a positive electrode that covers substantially an entire surface of a light-emitting layer and reflects the light emitted from the light emitting layer toward the light emitting layer.

Maruska discloses a nitride based LED including a transparent substrate 26, a lower layer 20, a topmost layer 12, a centrally located positive metal contact 16, and peripheral negative metal contact 14. See, for example, Figure 1B and Figure 7A. As disclosed in

column 8, lines 22-24, the positive and negative metal contacts 14 and 16 comprise highly reflective metal, which forms a mirrored or reflective surface 24 facing toward the transparent substrate 26.

There is no disclosure suggestion of a positive electrode that covers substantially an entire surface of a light-emitting layer of a light-emitting device and that reflects light from a light emitting layer toward the light emitting layer, as recited in claims 19 and 21. As discussed, the positive metal contact 16 of Maruska is centrally disposed and is surrounded by the peripheral negative metal contacts 14. The positive metal contact 16 of Maruska therefore does not cover substantially an entire surface of the light-emitting layer, as recited in claims 19 and 21. Even assuming it would have been obvious to combine Nemoto et al. and Maruska, such a combination would not have resulted in the invention of claims 19 and 21. Reconsideration and withdrawal of the rejection of claims 19 and 21 under 35 U.S.C. §103(a) over Nemoto et al. in view of Maruska are respectfully requested.

Claim 20 was rejected under 35 U.S.C. §103(a) over Nemoto et al. in view of Maruska and further in view of Vriens et al. (U.S. Patent 5,813,753). The rejection is respectfully traversed.

Claim 20 recites additional features of the invention and is allowable at least for the reasons discussed above with respect to claim 19 and for the additional features recited therein. In addition, it is respectfully submitted that Vriens et al. fail to cure the deficiencies of Nemoto et al. and Maruska with respect to claim 19.

Reconsideration and withdrawal of the rejection claim 20 under 35 U.S.C. §103(a) in view of Maruska and Vriens et al. are respectfully requested.

In view of the above amendments and remarks, Applicant respectfully submits that all the claims are allowable and that the entire application is in condition for allowance.

Should the examiner believe that anything further is desirable to place the application in better condition for allowance, the examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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Appendix (pp. 9-10)

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is changed as follows:

Page 10, the whole paragraph starting in line 13 is changed as follows:

A pair of bonding pads 11a and 11b made of an electrically conductive material are provided on one side of the base 10. On the same side of the base 10 is an area where the semiconductor Light-emitting device 20 is to be fixed. The bonding pads 11a and 11b can be made of any electrically conductive material and are formed by patterning on the base 10. The bonding pads 11a and 11b may have a plurality of [layer] layers made up of different materials.

Page 16, the whole paragraph starting in line 18 is changed as follows:

Fig. 6 shows the structure of the Light-emitting device 20. The Light-emitting device 20 is a light-emitting diode composed of a substrate 21, a buffer layer 22, an n-type GaN layer 23, an active layer 24, a p-type semiconductor layer 25, a negative electrode 26, and a positive electrode 27. The specifications of these members are tabulated below.

IN THE CLAIMS

Claims 14, 19 and 21 are amended as follows:

15. (Amended) A semiconductor light-emitting apparatus of flip chip bonding type, comprising:

a transparent base made of an inorganic material, which has on one side thereof a first bonding pad and a second bonding pad to be connected to a pair of lead frames with a space between the first and the second bonding pads where a semiconductor light-emitting element is [to be] fixed, the light-emitting element including a positive electrode that

covers substantially an entire surface of a light-emitting layer of the light-emitting element, and the positive electrode reflecting light emitted from the light-emitting layer toward the light-emitting layer.

20. (Amended) A pair of lead frames for use in a light-emitting apparatus of flip chip bonding type comprising:

a transparent base having on a first surface thereof a first and a second bonding pad and

a GaN semiconductor light-emitting device fixed on the first surface thereof,

wherein a first lead frame has a first mount which faces the dominant light emitting direction of the light-emitting apparatus and on which the first bonding pad is to be fixed, and a second lead frame has a second mount which faces the dominant light emitting direction and on which the second bonding pad is to be fixed, the light-emitting device including a positive electrode that covers substantially an entire surface of a light-emitting layer of the light-emitting device, and the positive electrode reflecting light emitted from the light-emitting layer toward the light-emitting layer.

21. (Amended) A light-emitting diode comprising:

a sapphire substrate;

a light emitting layer made of GaN semiconductor and formed on said sapphire substrate; and

a positive electrode formed on said light emitting layer;

wherein said positive electrode is supplied with electricity through a wire, [and] reflects light from said light emitting layer toward said sapphire substrate and covers substantially an entire surface of the light emitting layer.

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